



# ***Interactive comment on “Prediction of indoor radon concentrations in dwellings in the Oslo region – a model based on geographical information systems” by R. Kollerud et al.***

## **Anonymous Referee #2**

Received and published: 29 September 2013

This article reports the development of a method to assign radon concentration value inside each dwelling of the Oslo region. This method is based on various data-sets: indoor radon concentration measurements, airborne gamma-ray spectrometry measurements, type of bedrock and permeability of superficial sediments. This combined approach appears first as particularly interesting and should deserve attention in other countries/regions worldwide.

The paper is relatively clearly written in appropriate English. The method is generally well presented and the whole paper is thus easy to follow. However, the paper in its present form fails in numerous points and, according to me it is difficult to encourage

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it for publication in NHESS at that stage. The main points I found unsatisfactory are listed below with possible elements for substantial improvements:

1) First, this paper seems to be extremely and surprisingly close to the work carried out by Smethurst et al. (2008). This work is now clearly introduced thanks to the review report from Smethurst himself (and it was not the case before), but the authors provide only poor improvements to that work, except the larger data-set of indoor radon concentration measurements. Thus, emphasize needs to be done on this impressive data-set.

2) Second, I am not convinced when hazardous extrapolations are attempted for the assignment of a radon concentration value inside all the dwellings of such large and heterogeneous area. In particular, are never detailed the location of measurements nor the characteristics of the building (size, floors, basement, building material, ventilation). Instead, this precious information is unavailable at best or discarded at worst. It is true that the type of lithology is important for radon concentration in the basement, but at higher levels, when possible ventilation increases, the type of building materials can control in turn the radon concentration. The authors' statement concerning the assumed fact that timber cannot be a radon-rich emitter inside dwelling is not explained; it should be better to remain cautious. If I understood well, radon concentration was measured in the basement only inside a fraction of the dwellings investigated. I suggest, thus, relying first on a homogeneous data-set for which radon concentration is only measured in the basement. Afterwards, it will be interesting to refine the analysis by taking into account other measurement locations.

3) Third, and this point follows both points 1 and 2, I found that the data-set of radon concentration measurement in dwellings is not sufficiently well presented and then the manuscript itself loses of its intrinsic potential. This data-set should be regarded with care, classifying and gathering some data as a function of measurement location, type of dwelling... This is only barely attempted in some papers and, most often, never made properly. To be in possession of such a remarkable data-set, which I think is

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one of the most complete indoor radon concentration data-sets in Europe, is extremely interesting, and detailed statistical analysis has to be done carefully. This difficult and time-consuming work is definitely worthwhile, because it is possible that essential or even novel trends will be observed.

4) Fourth, figures and tables are not generally clear enough. For example no quantification is presented in Table 1 with any U content value. The link between uranium and radium, and worst between radium and radon, seem to be dismissed throughout the paper. One should recall that even in the case of bedrock with high uranium content, it is possible that radon cannot accumulate in dwelling basements due to several factors. One of the most critical factors can be the emanation factor.

5) Finally, radon concentration measurements were performed during 10 years at different sites and in different dwellings, but no information is given about the season during which these measurements were done. It is clear that major differences in radon concentration can be found between summer (15 °C, large precipitation) and winter (−2 °C, lower precipitation) in the Oslo region. The presence of snow around the dwelling can also affect the radon concentration inside the dwelling because snow blocks more efficiently radon emission.

Since these suggestions appear generally major, I opt for a rejection of your paper, with encouragements to resubmit. I hope that the comments above will help you to prepare a stronger manuscript.

The other points that deserve further attention are described below (P and L mean page and line, respectively):

1) P3046 L3: Please correct “indoor radon concentration measurement”. Avoid this type of jargon throughout the text.

2) P3046 L15-18: This sentence is not clear. Plus a sentence about interest of this manuscript for further studies should be inserted at the end of the abstract.

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- 3) P3046 L21: I do not used to read or write papers with sentence at present form when presenting previous studies.
- 4) P3047 L9-11: This sentence needs to be rewritten.
- 5) P3047 L27-28: Be cautious when dealing with timber. Differences can be observed for instance between coniferous and deciduous woods.
- 6) P3050 L6: Please correct “within few meters”.
- 7) P3051 L14-18: I am not sure potassium equivalent concentration exists. Please check.
- 8) P3053 L11-14: Please rewrite. Please correct everywhere “measures” with “measurements”.
- 9) P3053 L15-16: Please be consistent writing “dataset” or “data set”. I would suggest “data-set”.
- 10) P3053 L22: Please correct “assess”.
- 11) P3053 L23: Please correct “and can be interpreted”.
- 12) P3054 L24: Please correct “Pearson”.
- 13) P3054 L26 to P3055 L4: Please rewrite these sentences. I hope the reader knows the difference between AM and GM: please remove the definition parts. Please correct “these data were closer”.
- 14) P3055 L16: Space is missing “K and eU”.
- 15) P3056 L3: I do not understand the adjective “continuous” here as measurements were only punctual in time.
- 16) P3057 L4: Please rewrite this part of the sentence.
- 17) P3057 L7: Please correct with “percent”.

- 18) P3057 L21: Please check the reference.
- 19) P3058 L24: Please correct “the number of measurements”.
- 20) P3059 L10: It seems that the extrapolation is only useful when the site is slightly urbanized? Please be cautious with your conclusions here.
- 21) P3059 L12-18: This paragraph is important but should be inserted before in the methodology section (and should be deepened).
- 22) P3059 L20 to P3060 L17: In general a conclusion section is not a simple recall of all the points addressed in the paper. Rather it recalls briefly the main points, present future strategies to improve the current paper and opens perspectives.
- 23) P3060 L22: Please correct with “Smethurst”. Please check carefully the reference list and the paper to remove all the potential typos that may remain.
- 24) Table 2: Please correct the third line using English words.
- 25) Fig 2: There is no scale/coordinates in this figure.
- 26) Fig 3: I am not sure this flow chart is essential for the understanding of your method. Please also correct the Norwegian words with appropriate English words (“og” with “and” for example).
- 27) Fig 5: Please correct ‘Percent’. This type of plot is not sufficiently clear.
- 28) I suggest inserting other figures as introduced above presenting the indoor radon concentration data-set to strengthen the impact of the manuscript.

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